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McInturff

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[54] **ADJUSTABLE SEAT FOR WHEELCHAIRS**

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[73] Assignee: **Crown Therapeutics, Inc.**, Belleville, Ill.

[21] Appl. No.: **09/179,053**

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Related U.S. Application Data

[63] Continuation-in-part of application No. 08/847,702, Apr. 28, 1997.

[51] **Int. Cl.**[6] **A47C 7/02**

[52] **U.S. Cl.** **297/440.24**; 297/440.22; 297/452.4; 297/DIG. 6; 297/452.2; 248/298.1

[58] **Field of Search** ..... 297/452.2, 452.4, 297/440.22, 440.2, 440.24, 252, DIG. 6; 248/205.2, 298.1, 200.1

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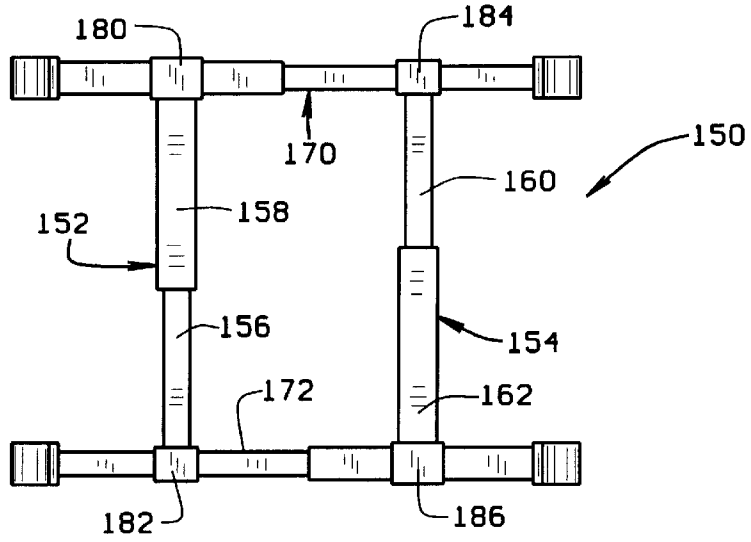
Assistant Examiner—David E. Allred
Attorney, Agent, or Firm—Howell & Haferkamp, L.C.

[57] **ABSTRACT**

A size-adjustable wheelchair seat comprises a first size-adjustable frame member, a second size-adjustable frame member and a cross frame member. The first frame member extends generally in a longitudinal direction. The first frame member includes a first penetrating frame element and a first receiving frame element. An end of the first penetrating frame element is telescoped within an end of the first receiving frame element. The second frame member is spaced laterally from and extends generally parallel to the first frame member. The second frame member includes a second penetrating frame element and a second receiving frame element. An end of the second penetrating frame element is telescoped within an end of the second receiving frame element. The cross frame element extends between the first frame member and the second frame member. The cross frame element comprises a first generally tubular sleeve portion, a second generally tubular sleeve portion and an elongate body extending between the first and second sleeve portions. The first sleeve portion is adapted to surround the first frame member. The second sleeve portion is adapted to surround the second frame member. The first and second sleeve portions are slidable longitudinally along the first and second frame members, respectively.

15 Claims, 6 Drawing Sheets



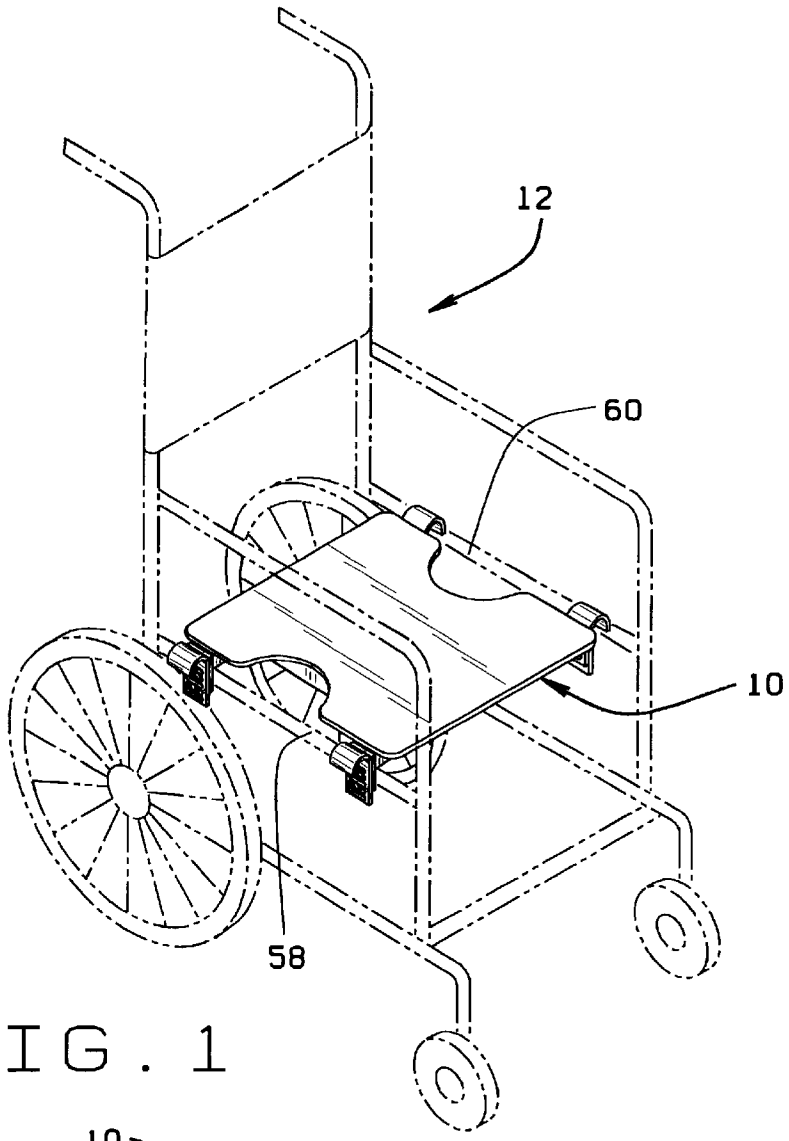


FIG. 1

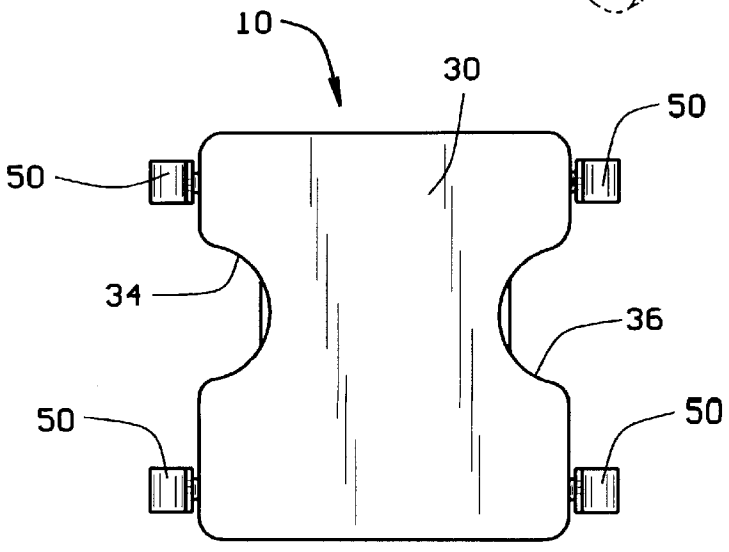


FIG. 2

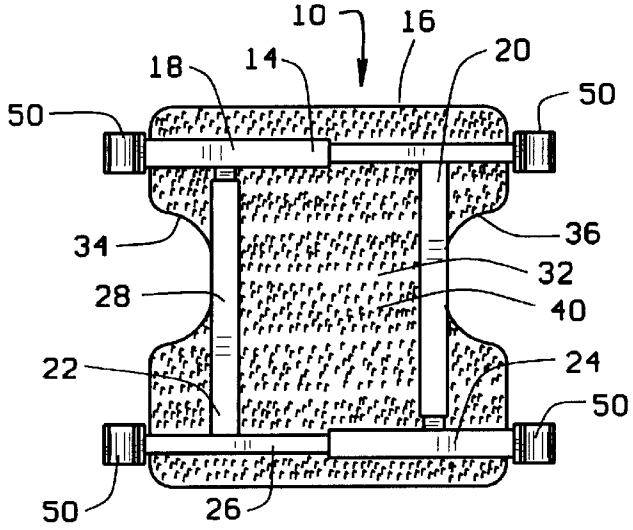


FIG. 3

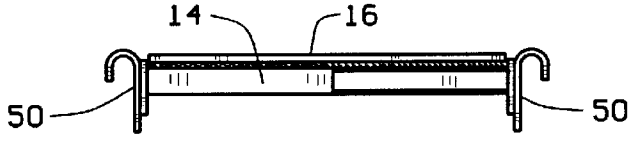


FIG. 4

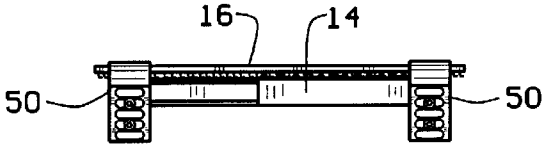


FIG. 5

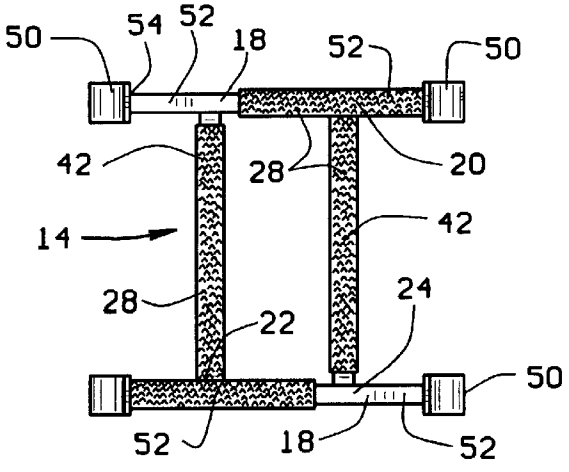


FIG. 6

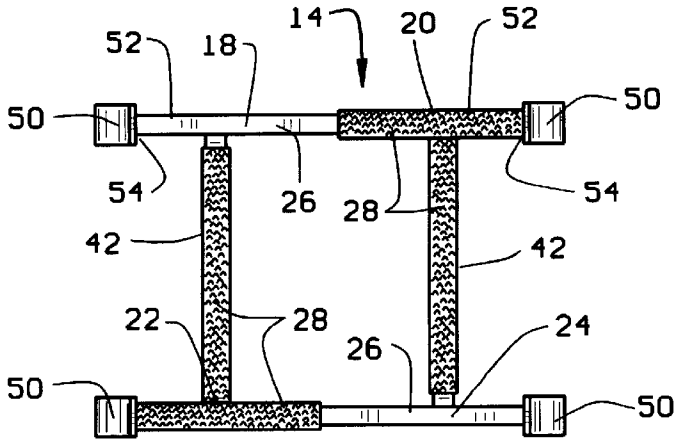


FIG. 7

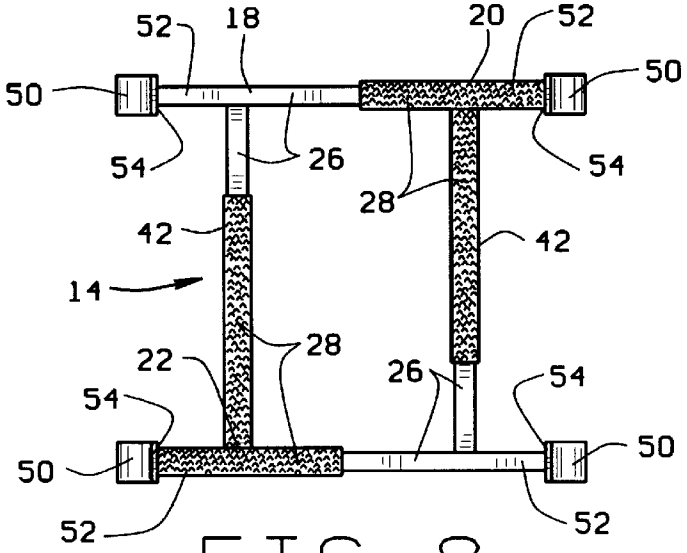


FIG. 8

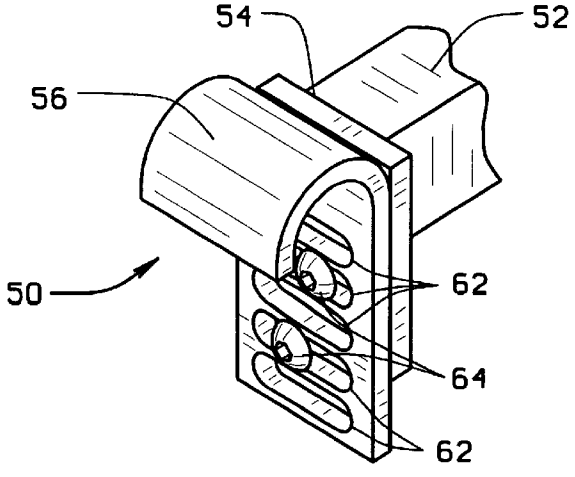


FIG. 9

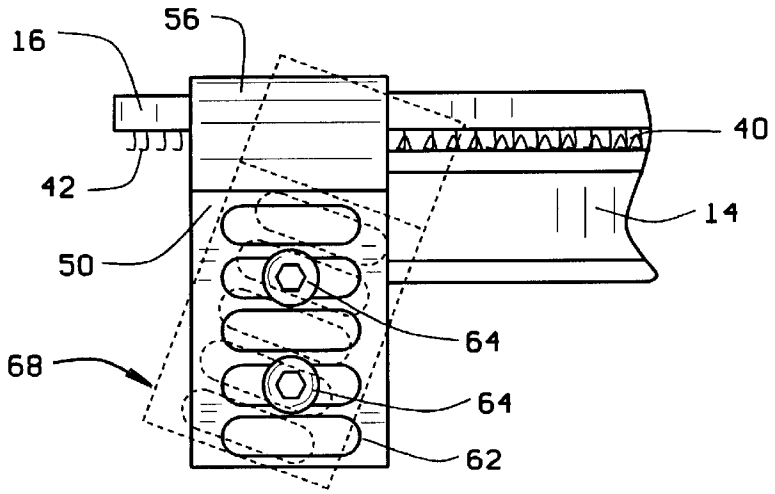


FIG. 10

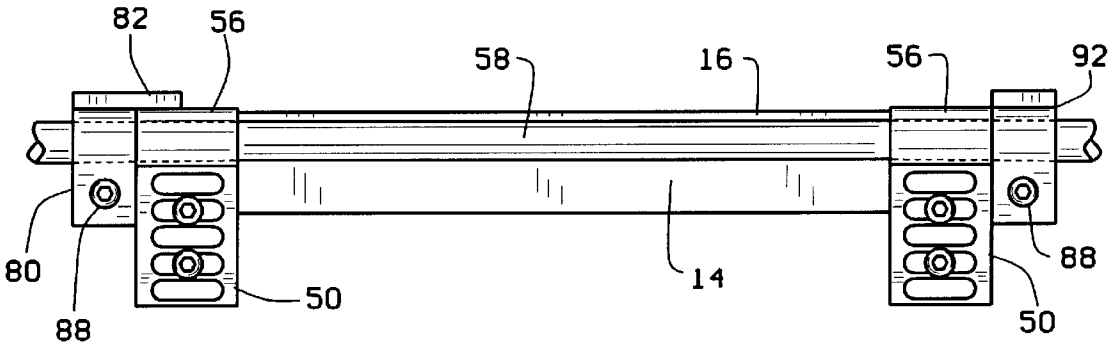


FIG. 13

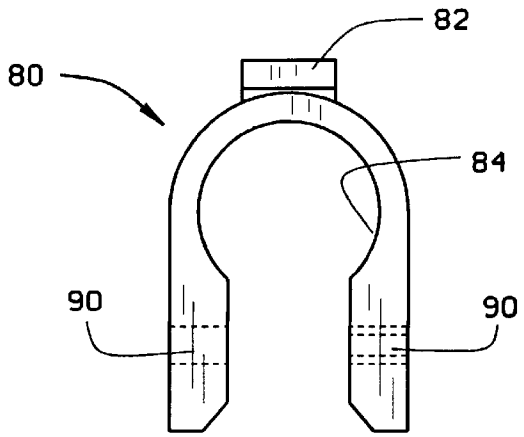


FIG. 12

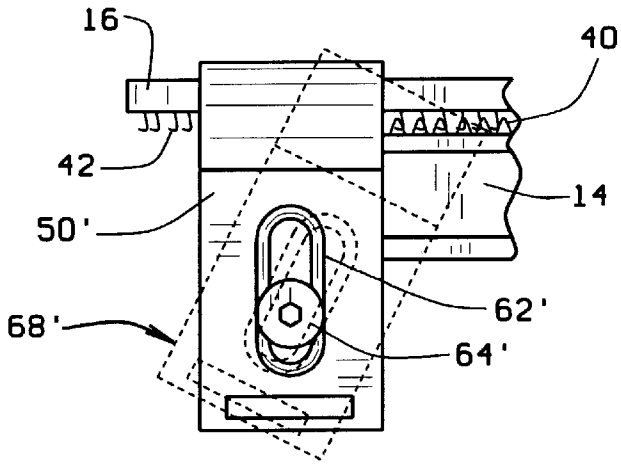


FIG. 11

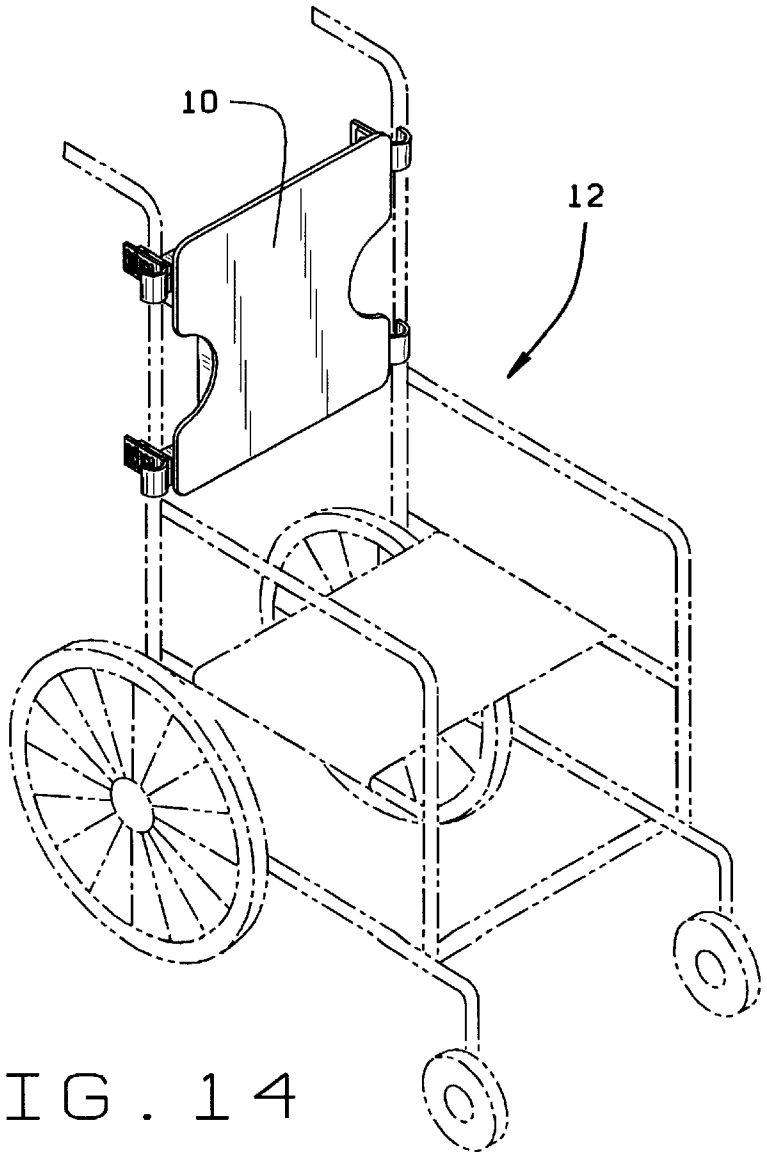


FIG. 14

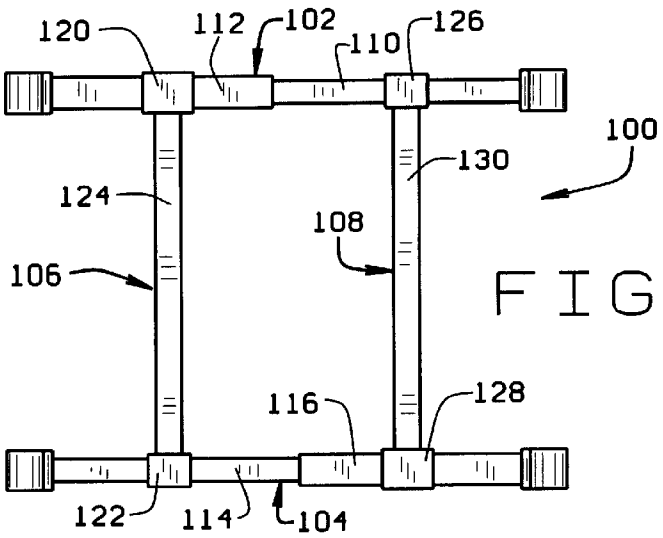


FIG. 15

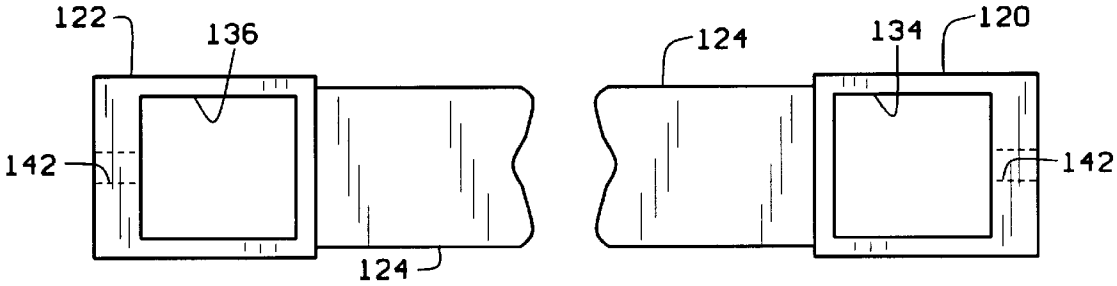


FIG. 16

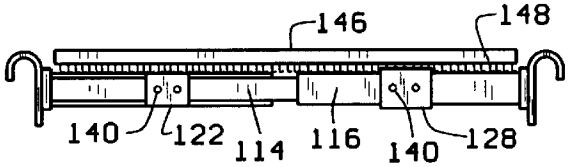


FIG. 17

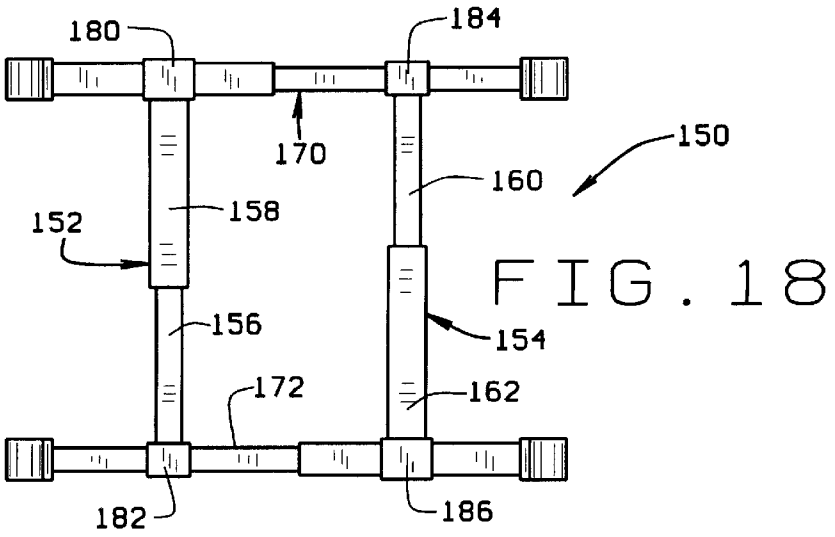


FIG. 18

ADJUSTABLE SEAT FOR WHEELCHAIRS

This Application is a continuation-in-part of co-pending application Ser. No. 08/847,702 entitled "Size-Adjustable Load Supporting Device For Wheelchairs", filed Apr. 28, 1997.

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention pertains to a load supporting device for use with conventional wheelchair frames. More particularly, the present invention pertains to a wheelchair seat which is adjustable to fit most conventional wheelchair frames and to accommodate different sized wheelchair patients.

(2) Description of the Related Art

In a conventional wheelchair, a soft "sling" type seat is suspended between spaced apart rails of the wheelchair frame for supporting the weight of the wheelchair user. However, these soft "sling" type wheelchair seats can aggravate many of the health problems suffered by wheelchair users.

Persons who use wheelchairs for extended periods of time may require the use of inflatable wheelchair seat cushions to prevent the formation of decubitus ulcers. Inflatable wheelchair cushions, such as the one disclosed in co-assigned U.S. Pat. No. 5,561,875, serve to distribute the weight of the supported body evenly over the area of the body that is in contact with the cushion. The inflatable cushions are generally placed on top of the wheel chair seat. However, the effectiveness of such inflatable cushions is significantly diminished by the curved configuration of a conventional "sling" type wheelchair seat. Moreover, by stacking an inflatable cushion on top of the "sling" seat, the effective seat height is raised an amount equal to the thickness of the inflatable cushion. This may result in the patient not being able to properly reach the foot plates of the wheelchair. It also raises the center of gravity of the patient.

Attempts have been made to replace the "sling" type wheelchair seat with a flat, rigid seat base which can be suspended low enough between the spaced apart rails of the wheelchair frame to accommodate the thickness of an inflatable cushion. For example, U.S. Pat. No. 4,629,246 of Fulton discloses a rigid wheelchair seat base which is hook mounted onto a wheelchair frame. The seat base can be easily removed to facilitate collapsing of the wheelchair for transportation and storage. However, the seat base disclosed in the Fulton patent is not, under normal circumstances, size-adjustable. Consequently, the seat base must be custom constructed for each individual wheelchair and wheelchair user. This can become expensive, even for a single wheelchair user who may require different seat bases as his or her physical needs change over time.

More recently, attempts have been made to provide size-adjustable wheelchair seat bases which can be adjusted to fit a variety of wheelchair frames and to accommodate the current and changing needs of the wheelchair user. For example, U.S. Pat. No. 5,074,620 of Jay et al. discloses a wheelchair seat base which may be adapted to fit a variety of wheelchair frames and which is adjustable to fit different sized users. However, the means for adjusting the length and width of the seat are quite cumbersome and require the use of tools to accomplish any size adjustment. Moreover, the size-adjustment means are rather limited with the seat base being capable of only a few different sizes.

Another problem that arises when using rigid seat bases that are suspended between the spaced apart rails of the wheelchair frame is limited vertical adjustability. As discussed above, in many circumstances, a patient requires an inflatable wheelchair seat cushion to be placed on top of the wheel chair seat. This requires the that the seat base be suspended lower between the spaced apart rails of the wheelchair frame in order to maintain the same effective seat height. However, in many prior art wheelchair seat structures, the seat base can only be lowered a short distance before the seat base and/or the frame structure that supports the seat base intersect the cross braces or "struts" of the wheelchair frame. Attempts have been made to overcome this problem by providing slots or cut-outs in the seat base or panel to accommodate the presence of such cross braces or "struts". For example, U.S. Pat. No. 4,629,246 of Fulton discloses a wheelchair seat with a rigid base having a pair of slots cut into the side edges of the base plate to accommodate the struts of the wheelchair frame on which the seat is mounted.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a size-adjustable load supporting device for wheelchairs which may be quickly and easily adjusted, without tools, to fit most conventional wheelchair frames and to accommodate most wheelchair users. It is also an object of this invention to provide a device that, while being easily size-adjustable, provides sound mechanical support for the wheelchair user. Still another object is to provide a load supporting device capable of being mounted to a conventional wheelchair frame at a variety of angles to achieve various therapeutically significant functions. A further object of this invention is to provide a size-adjustable load supporting device which may be retrofitted onto the majority of existing conventional wheelchairs, or which can be used as original equipment on new wheelchairs. Yet another object of this invention is to provide a load supporting device having a frame structure with moveable cross frame elements adapted to accommodate for braces and support members of a conventional wheelchair frame without unduly limiting the vertical adjustability of the load supporting device.

In one embodiment of the invention, the support frame has a generally square configuration which is defined by four substantially T-shaped frame components which are mounted together. The T-shaped frame components are dimensioned to slidably nest with one another at a range of spaced apart distances. Some of the components are penetrating components and others are receiving components which are configured for telescoping reception of the penetrating components. The spaced apart distances of the frame components relative to one another therefore depends upon the degree of nesting or telescoping of the components.

By varying the amount of nesting or telescoping of the T-shaped frame components, the support frame can be quickly and easily adjusted to a number of lengths and widths. Thus, the support frame is size-adjustable to fit most conventional wheelchair frames and to accommodate wheelchair patients of various sizes. As the physical needs of the wheelchair user change, the device can be size-adjusted to accommodate those needs. The T-shaped frame components may include spring biased detent mechanisms for preventing the frame components from being inadvertently unnested during adjustment of the support frame.

The size-adjustable load supporting device includes a load supporting panel which is removably fastened to the support frame. The load supporting panel serves two primary functions. First, when fastened to the support frame, the panel

secures the four T-shaped components at a desired spaced apart distance from one another to thereby define a length and depth of the support frame. Second, the panel serves to support the weight of the wheelchair patient.

Preferably, the load supporting panel is removably fastened to the size-adjustable support frame with a suitable hook and loop fastener, such as VELCRO®. The "loop" part of the hook and loop fastener covers substantially the entire bottom surface of the panel. The "hook" part of the hook and loop fastener covers at least a portion of the size-adjustable support frame. Preferably, at least a portion of each frame component with be covered on a top surface with the "hook" part of the fastener. Thus, when fastened to the support frame, the panel secures the positions of the frame components relative to one another to thereby define a rigid wheelchair support having a desired length and width.

The size-adjustable load supporting device of the present invention can be used to replace the conventionally used "sling" type wheelchair seat by mounting the system substantially horizontally between the spaced apart rails of a conventional wheelchair frame. Alternatively, the same device can be mounted substantially vertically on a conventional wheelchair frame so that the load supporting panel is used as a back rest for the wheelchair user.

The size-adjustable load supporting device includes four substantially J-shaped mounting brackets for mounting the device to a conventional wheelchair frame, one of the J-shaped brackets being connected to each of the T-shaped frame components. The hook portion of the "J" is adapted for engaging the spaced apart rails of a conventional wheelchair so that the load supporting panel of the device is suspended between the spaced apart rails.

Preferably, each J-shaped mounting bracket includes a plurality of laterally extending slots through which bolts, or other mechanical fasteners, slidably and rotatably connect the bracket to the extended segments of the support frame. Each bracket is therefore slidably and rotatably adjustable relative to the support frame. In an alternative embodiment, each bracket includes a longitudinally extending slot through which a bolt, or other mechanical fastener, slidably connects the bracket to the support frame.

Each of the J-shaped brackets is independently adjustable, slidably and rotatably, to thereby allow the device to be mounted to a conventional wheelchair frame at a variety of angles to achieve various therapeutically significant functions. For example, when the device is used as a seat base, the mounting brackets can be adjusted to provide a forward or rearward tilt to the seat base, or to create a tilt to one side or the other.

Front and rear locking clips are used to prevent the J-shaped mounting brackets from sliding along the rails of the wheelchair frame. Front locking clips are attached to the rails to prevent the front mounting brackets from sliding forwardly and prevent the device from moving out of position. Rear locking clips are attached to the rails behind the rear mounting brackets to prevent them from sliding rearwardly. The rear locking clips each include a tongue which is placed over the top of the hook portion of the rear mounting brackets to prevent the hook portion of the rear mounting brackets from inadvertently disengaging the rails.

In another aspect of the invention, a size-adjustable wheelchair seat comprises a first size-adjustable frame member, a second size-adjustable frame member and a cross frame member. The first size-adjustable frame member extends generally in a longitudinal direction and includes a first penetrating frame element and a first receiving frame element. An end of the first penetrating frame element is telescoped within an end the first receiving frame element. The second size-adjustable frame member is spaced laterally from and extends generally parallel to the first size-adjustable frame member. The second size-adjustable frame member includes a second penetrating frame element and a second receiving frame element. An end of the second penetrating frame element is telescoped within an end the second receiving frame element. The cross frame element extends laterally between the first and second size-adjustable frame members and is moveable longitudinally along the frame members.

In yet another aspect of the invention, a adjustable wheelchair seat comprises a first frame member, a second frame member and a cross frame member. The first frame member extends generally in a longitudinal direction. The second frame member is spaced laterally from and extends generally parallel to the first frame member. The cross frame element extends laterally between the first frame member and the second frame member. The cross frame element comprises a first generally tubular sleeve portion, a second generally tubular sleeve portion and an elongate body extending between the first and second sleeve portions. The first sleeve portion extends around the first frame member, the second sleeve portion extends around the second frame member, and the first and second sleeve portions are slidable longitudinally along the first and second frame members, respectively.

While the principal advantages and features of the present invention have been described above, a more complete and thorough understanding and appreciation for the invention may be attained by referring to the drawings and description of the preferred embodiment which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of the size-adjustable load supporting device of the present invention being used as a seat base mounted to a conventional wheelchair frame (shown in phantom).

FIG. **2** is a top view of the size-adjustable load supporting device.

FIG. **3** is a bottom view of the size-adjustable load supporting device.

FIG. **4** is a front elevational view of the size-adjustable load supporting device.

FIG. **5** is a side elevational view of the size-adjustable load supporting device.

FIG. **6** is a top view of a variant embodiment of the device, shown with the load supporting panel removed and with the support frame components fully nested with one another.

FIG. **7** is a top view of the device of FIG. **6**, shown with the load supporting panel removed and with the amount of nesting in some of the support frame components adjusted to widen the support frame.

FIG. **8** is a top view of the device of FIG. **6**, shown with the load supporting panel removed and with the amount of nesting in the support frame components adjusted to lengthen and widen the support frame.

FIG. **9** is an isometric detail view of one of the J-shaped mounting brackets of the device.

FIG. **10** is a side detail view of one of the J-shaped mounting brackets of the device, with an alternate rotated position of the bracket shown in phantom.

FIG. **11** is a side detail view of an alternate embodiment of the J-shaped mounting brackets of the device, with a rotated position of the bracket shown in phantom.

FIG. **12** is an end detail view of one of the horseshoe locking clips used in the present invention.

FIG. **13** is a side elevational view of the size-adjustable load supporting device mounted to the cross brace of a conventional wheelchair frame.

FIG. **14** is an isometric view of the size-adjustable load supporting device of the present invention being used as a back rest mounted to a conventional wheelchair frame (shown in phantom).

FIG. **15** is a top plan view of another embodiment of a support frame for a wheelchair seat having slidable cross beam elements.

FIG. **16** is an enlarged, fragmented side elevation view of one of the slidable cross beam elements used in the support frame of FIG. **15**.

FIG. **17** is a front elevation view of the support frame of FIG. **15** with a load-supporting panel fastened thereto by hook and loop fasteners.

FIG. **18** is a top plan view of yet another embodiment of a support frame for a wheelchair seat having telescoping cross beam elements.

Reference numerals in these Figures correspond to reference numerals in the following detailed description.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The size-adjustable load supporting device of the present invention may be used with a conventional wheelchair frame. The device is shown generally as **10** in FIG. **1** in the environment of a conventional wheelchair, which is depicted in phantom as **12**. As shown in FIG. **1**, the device **10** is preferably used as a seat base in place of a conventional soft "sling" type wheelchair seat. As best shown in FIGS. **3–5**, the size-adjustable load supporting device **10** is generally comprised of a size-adjustable support frame **14** and a load supporting panel **16** removably fastened to the support frame **14**.

In the preferred embodiment of the present invention, the support frame **14** has a generally square configuration which, as shown in FIGS. **3**, **6**, **7** and **8**, is defined by four substantially T-shaped frame components **18**, **20**, **22**, **24** which are mounted together. The T-shaped frame components **18**, **20**, **22**, **24** are preferably constructed from extruded aluminum tubing having a square cross section, but could be constructed from other materials which would function equivalently. The T-shaped frame components **18**, **20**, **22**, **24** are dimensioned to slidably nest with one another at a range of spaced apart distances.

Each T-shaped frame component is defined by two legs **26** or **28** which intersect to form a "T". As shown in FIGS. **6–8**, some of the legs **26** are penetrating legs and other legs **28** are receiving legs. The penetrating legs **26** have a first cross-sectional dimension and the receiving legs **28** have a second cross-sectional dimension larger than the first cross-sectional dimension. Thus, the receiving legs **28** are configured for telescoping reception of the penetrating legs **26**.

In FIGS. **6**, **7** and **8**, the support frame **14** is shown to include two T-shaped frame components **18**, **22** comprised solely of receiving legs **28** and two T-shaped frame components **20**, **24** comprised solely of penetrating legs **26**. It is to be understood, however, that other configurations could be used without departing from the scope of this invention. For example, as shown in FIGS. **3–5**, each T-shaped frame component could consist of one penetrating leg **26** and one receiving leg **28**.

The spaced apart distances of the T-shaped frame components **18**, **20**, **22**, **24** relative to one another depends upon the degree of nesting or telescoping of the components. By varying the amount of nesting or telescoping of the components **18**, **20**, **22**, **24** the support frame **14** can be quickly and easily adjusted to a number of lengths and widths. Thus, the support frame **14** is size-adjustable to fit most conventional wheelchair frames and to accommodate wheelchair patients of various sizes.

In FIG. **6**, the support frame **14** is shown with the T-shaped frame components **18**, **20**, **22**, **24** fully nested with one another. FIG. **7** shows the support frame **14** with the amount of nesting adjusted laterally to widen the frame. FIG. **8** shows the support frame **14** with the amount of nesting adjusted both laterally and longitudinally to thereby lengthen and widen the frame.

The T-shaped frame components **18**, **20**, **22**, **24** may employ spring biased detent mechanisms for preventing the frame components from being inadvertently unnested during adjustment of the support frame **14**. Such detent mechanisms are well known in the art. Preferably, each receiving leg **28** includes a detent hole (not shown) located near its distal end, and each penetrating leg **26** includes a spring biased detent pin (not shown) near its distal end. The detent hole is configured to receive the detent pin when the detent pin and detent hole are aligned with one another. When the penetrating leg **26** and receiving leg **28** are adjusted relative to one another so that the detent pin is aligned with the detent hole, the detent pin springs into a locked position. The detent pin can be moved back to the unlocked position by manually depressing the pin against the spring bias. In the unlocked position, the detent pin is free to slide along an interior surface of the receiving leg **28**. It is to be understood that locking means other than the spring bias detent mechanism described above may be employed to preventing inadvertent unnesting of the frame components.

As best shown in FIGS. **2** and **3**, the device **10** includes a load supporting panel **16** having a generally square shape. The panel **16** has a top surface **30** and a bottom surface **32** and includes two laterally opposite cut-outs **34**, **36** which allow for various configurations of wheelchair cross bars.

The load supporting panel **16** is removably fastened to the support frame **14**. When fastened to the support frame **14**, the panel **16** fixes the four T-shaped components **18**, **20**, **22**, **24** at a desired spaced apart distance from one another to thereby define a fixed length and depth of the support frame **14**. The panel **16** also serves as a durable, lightweight seat capable of accommodating the weight of the majority of wheelchair patients. Preferably, the panel **16** is made of acrylonitrile butadiene styrene resin (commonly referred to as ABS) or a composite equivalent, but could be constructed from any durable, lightweight material which resists bowing and rotting.

In the preferred embodiment, the load supporting panel **16** is removably fastened to the size-adjustable support frame **14** with a suitable hook and loop fastener, such as VELCRO®. The "loop" part **40** of the hook and loop fastener covers substantially the entire bottom surface **32** of the panel **16**. The "hook" part **42** of the hook and loop fastener covers portions of the size-adjustable support frame **14**. It is to be understood that the roles of the "hook" and "loop" parts could be reversed without departing from the scope of this invention. It is also to be understood that means other than a hook and loop fastener could be used for removably fastening the panel **16** to the support frame **14**. However, a hook and loop fastener is preferred because, among other things, it is relatively inexpensive and requires no tools of any kind.

To ensure that each frame component **18**, **20**, **22**, **24** is properly secured with respect to the others, at least a portion of each receiving leg **28** should be covered with the "hook" part **42** of the fastener. Thus, when fastened to the support frame **14**, the panel **16** secures the positions of the frame components **18**, **20**, **22**, **24** relative to one another to thereby define a rigid wheelchair seat having a desired length and width which is fixed.

The size-adjustable load supporting device **10** includes four substantially J-shaped mounting brackets **50** for mounting the device **10** to a conventional wheelchair frame **12**. FIGS. **9** and **10** show detailed views of the J-shaped mounting brackets **50**. One of the brackets **50** is connected to each of the T-shaped frame components **18**,**20**,**22**,**24**.

As described above, each of the T-shaped frame components **18**, **20**, **22**, **24** is defined by two intersecting legs which define the "T". As shown in FIGS. **3**, **6**, **7** and **8**, one leg of each "T" includes an extended segment **52** which extends out laterally beyond the intersection of the two legs. One J-shaped bracket **50** is connected to the distal end **54** of each extended segment **52**.

The hook portion of the "J" **56** is adapted for engaging the spaced apart rails **58**, **60** of a conventional wheelchair **12** so that the load supporting panel **16** of the device **10** is suspended between the spaced apart rails **58**, **60**. The hook portions **56** of the J-shaped brackets **50** are dimensioned to snap freely on to most standard rails **58**, **60** and can be easily removed from the rails.

As best shown in FIGS. **9** and **10**, each J-shaped mounting bracket **50** includes a plurality of laterally extending slots **62** through which bolts **64**, or other mechanical fasteners, connect the bracket **50** to the extended segments **52** of the support frame **14**. In the preferred embodiment, each bracket **50** includes five laterally extending slots **62** arranged in a vertical series to permit vertical adjustment of the device **10** relative to the wheelchair frame **12**.

Each bracket **50** is laterally slidable relative to the support frame **14**. Each bracket **50** is also rotatable relative to the support frame **14**. FIG. **10** illustrates a rotated position **68** of the J-shaped bracket **50**.

FIG. **11** illustrates an alternative embodiment of the J-shaped mounting bracket **50'** including a longitudinally extending slot **62'** through which bolt **64'**, or an equivalent mechanical fastener, slidably and rotatably connects the bracket **50'** to the extended segments **52** of the support frame **14**. FIG. **11** also shows a rotated position **68'** of bracket **50'**.

Each of the J-shaped brackets **50** and **50'** is independently adjustable, slidably and rotatably, to thereby allow the device **10** to be mounted to a conventional wheelchair frame **12** at a variety of angles to achieve various therapeutically significant functions. For example, the mounting brackets **50** and **50'** can be adjusted to tilt the user back in the chair to improve stability. As another example, the mounting brackets **50** and **50'** on only one side of the device **10** could be raised to create a tilt to one side or the other.

As described above, the size-adjustable load supporting device of the present invention can be used to replace the conventionally used "sling" type wheelchair seat by mounting the device **10** substantially horizontally between the spaced apart rails **58**, **60** of a conventional wheelchair frame **12**. Also, if an inflatable wheelchair cushion (such as the one disclosed in co-assigned U.S. Pat. No. 5,561,875) is being used, the device **10** can be suspended low enough between the spaced apart rails of the wheelchair frame to accommodate for the thickness of the cushion.

In the alternative use shown in FIG. **12**, the same device **10** can be mounted substantially vertically on a conventional wheelchair frame **12** with the load supporting panel **16** being used as a back rest for the wheelchair user. When used as a back rest, the device may require mounting brackets other than the J-shaped mounting brackets **50** described above in order to keep from falling off of the back of the wheelchair frame **12**. Selection of appropriate mounting brackets suitable for this alternative use of the device **10** would clearly be within the knowledge of one skilled in the art.

In the preferred embodiment of the present invention, front locking clips **92** and rear locking clips **92** are used to prevent the J-shaped mounting brackets **50** from sliding along rails **58** and **60** of the wheelchair frame **12**. As shown in FIG. **13**, a front locking clip **92** is attached to the rail **58** in front of the J-shaped mounting bracket **50**. The front locking clip **92** prevents the mounting bracket **50** from sliding forwardly and prevents the device **10** from moving out of position. The front locking clip **92**, however, does not prevent the mounting bracket **50** from being vertically disengaged from the rail **58**. Therefore the device **10** may be snapped out so that the wheelchair may be collapsed for transportation and storage.

As shown in FIG. **13**, the rear locking clip **80** may be attached to the back of the rail **58** behind the rear mounting bracket **50**. The rear locking clip **80** includes a tongue **82** which may be placed over the top of the hook portion **56** of the mounting bracket **50**. FIG. **14** shows an end detail view of the locking clip. The rear locking clip **80** prevents the mounting bracket **50** from sliding rearwardly, and the tongue **82** prevents the hook portion **56** of the mounting bracket **50** from inadvertently disengaging the rail **58**.

Both locking clips **80** and **92** are mounted on rails **58** and **60** with bolts **88**, or other equivalent mechanical fasteners. To mount the device **10** on the wheelchair frame **12**, the hook portion **56** of the rear mounting brackets **50** are snapped onto the rails **58** and **60** and then slid back under the tongues **82** of the rear locking clips **80**. The front mounting brackets **50** are then snapped onto the rails **58** and **60** immediately behind the front locking clips **92**.

FIG. **15** is a top plan view of another embodiment of a support frame **100** for a wheelchair seat. Except as described below, the support frame is similar in all respects to the support frame **14** described above. The support frame **100** has a generally square configuration defined by a first size-adjustable frame member **102** which extends generally in a longitudinal direction, a second size-adjustable frame member **104** spaced laterally from and extending generally parallel to the first size-adjustable support frame member **102**, a first cross frame element **106** and a second cross frame element **108**. The first size-adjustable frame member **102** includes a first penetrating frame element **110** and a first receiving frame element **112**. The first receiving frame element **112** is dimension for telescoping reception of the first penetrating frame element **110**. As shown in FIG. **15**, an end of the first penetrating frame element **110** is telescoped within an end of the first receiving frame element **112**. The second size-adjustable frame member **104** includes a second penetrating frame element **114** and a second receiving frame element **116**. Like the frame elements of the first size-adjustable frame member, the second receiving frame element **116** is dimension for telescoping reception of the second penetrating frame element **114** and, as shown in FIG. **15**, an end of the second penetrating frame element **114** is telescoped within an end of the second receiving frame element **116**. By adjusting the amount of telescoping, the width of the support frame can be adjusted.

The cross frame elements **106** and **108** extend between the first size-adjustable frame member **102** and the second

size-adjustable frame member **104** and, as shown in FIG. **15**, are preferably generally perpendicular to the first and second size-adjustable support frame members **102** and **104**. As described below more fully, the cross frame elements **106** and **108** are moveable longitudinally along the first and second size-adjustable frame members. Preferably, the cross frame elements **106** and **108** are moveable independently of one another. The longitudinal moveability of the cross frame elements **106** and **108** allows the support frame **100** to be adjusted to accommodate for the cross braces or "struts" of the wheelchair frame on which the wheelchair seat is mounted. This provides a greater range of vertical adjustability for the wheelchair seat.

The first cross frame element **106** includes a first generally tubular sleeve portion **120**, a second generally tubular sleeve portion **122** and an elongate first body portion **124** extending between the first and second generally tubular portions **120** and **122**. The second cross frame element **108** includes a third generally tubular sleeve portion **126**, a fourth generally tubular sleeve portion **128** and an elongate second body portion **130** extending between the third and fourth generally tubular portions **126** and **128**. Preferably, the first sleeve portion **120** is adapted to surround or circumscribe the first receiving frame element **112** of the first size-adjustable frame member **102**, and the second sleeve portion **122** is adapted to surround or circumscribe the second penetrating frame element **114** of the second size-adjustable frame member **104**. Also preferably, the third sleeve portion **126** is adapted to surround or circumscribe the first penetrating frame element **110** of the first size-adjustable frame member **102**, and the fourth sleeve portion **128** is adapted to surround or circumscribe the second receiving frame element **116** of the second size-adjustable frame member **104**. Thus, the first and third sleeve portions **120** and **126** are slidable longitudinally along the first size-adjustable frame member **102** and the second and fourth sleeve portions **122** and **128** are slidable longitudinally along the second size-adjustable frame member **104**.

FIG. **16** is an enlarged, fragmented side elevation view of the first cross frame element **106** (as viewed looking from right to left in FIG. **15**). As shown in FIG. **16**, the first sleeve portion **120** has an interior surface **134** configured to fit around an exterior surface of the first receiving frame element **112** of the first size-adjustable frame member **102**. The second sleeve portion **122** has an interior surface **136** configured to fit around an exterior surface of the second penetrating frame element **114** of the second size-adjustable frame member **104**. Similarly, the third sleeve portion **126** has an interior surface (not shown, but similar to the interior surface **136** of the second sleeve portion **122**) configured to fit around an exterior surface of the first penetrating frame element **110** of the first size-adjustable frame member **102**, and the fourth sleeve portion **128** has an interior surface (not shown, but similar to the interior surface **134** of the first sleeve portion **120**) configured to fit around an exterior surface of the second receiving frame element **116** of the second size-adjustable frame member **104**.

As shown in FIG. **17**, the second sleeve portion **122** includes a pair of set screws **140** adapted for engagement with the exterior surface of the second penetrating frame member **114**, and the fourth sleeve portion **128** includes a pair of set screws **140** adapted for engagement with the exterior surface of the second receiving frame member **116**. The first and third sleeve portions include similar set screws (not shown) adapted for engagement with the exterior surfaces of the first receiving frame member **112** and the first penetrating frame member **110**, respectively. Preferably, the set screws **140** are externally threaded and are in threading engagement with internally threaded through bores **142** in the sleeve portions **120**, **122**, **126** and **128**. The set screws **140** are tightened to secure the cross frame elements **106** and **108** at selected longitudinal positions along the first and second size-adjustable frame members **102** and **104**.

The embodiment of the wheelchair seat shown in FIGS. **15–17** further comprises a load supporting panel **146**. The panel is similar in all respects to the panel **16** described above. Preferably, the panel **146** is removably fastened to the support frame **100** with a hook and loop fastener **148** in the same way that the panel **16** is removably fastened to the support frame **14** described above. One component (i.e., either the hook component or the loop component) of the hook and loop fastener is applied to a bottom surface of the panel **146** and the other component of the hook and loop fastener is applied to the upper surfaces of portions of the first size-adjustable frame member **102**, second size-adjustable frame member **104**, first cross frame element **106** and second cross frame element **108**.

Thus, the panel **146** is adapted for securing the first and second cross frame elements **106** and **108** at selected longitudinal positions relative to one another and relative to the first and second size-adjustable frame members **102** and **104** when the panel **146** is fastened to the support frame **100**. Similarly, the panel **146** serves to secure the penetrating and receiving frame elements of the first and second size-adjustable frame members **102** and **104** relative to one another. The panel can therefore serve as an alternative means for securing the components of the support frame **100** relative to one another, or can work together with the set screws to maintain the components of the support frame **100** in their desired relative positions.

FIG. **18** is a top plan view of yet another embodiment of a support frame **150** having first and second size-adjustable cross frame elements **152** and **154**. The first size-adjustable cross frame element **152** includes a third penetrating frame element **156** and a third receiving frame element **158**, and the second size-adjustable cross frame element **154** includes a fourth penetrating frame **160** element and a fourth receiving frame element **162**. As shown in FIG. **18**, an end of the third penetrating frame element **156** is telescoped within an end the third receiving frame element **158**, and an end of the fourth penetrating frame element **160** is telescoped within an end the fourth receiving frame element **162**. The embodiment of FIG. **18** includes first and second size-adjustable frame members **170** and **172** that are similar in all respects to the embodiment of FIGS. **15–17**. The embodiment of FIG. **18** also includes generally tubular sleeve portions **180**, **182**, **184** and **186** that are similar in all respects to the tubular sleeve portions **120**, **122**, **126** and **128** shown in FIGS. **15–17**.

While the present invention has been described by reference to a specific embodiment and a particular use, it should be understood that other configurations could be constructed, and different uses could be made, without departing from the scope of the invention as set forth in the following claims.

What is claimed is:

1. A size-adjustable wheelchair seat comprising:

a first size-adjustable frame member extending generally in a longitudinal direction, the first size-adjustable frame member including a first penetrating frame element and a first receiving frame element, an end of the first penetrating frame element being telescoped within an end of the first receiving frame element;

a second size-adjustable frame member spaced laterally from and extending generally parallel to the first size-adjustable frame member, the second size-adjustable frame member including a second penetrating frame element and a second receiving frame elements, an end of the second penetrating frame element being telescoped will an end of the second receiving frame element; and

first and second cross frame elements extending between and connected to each of the first and second size-adjustable frame members, each of the first and second cross frame elements being movably mounted to the first and second size-adjustable frame members in a manner to permit independent movement of each of the first and second cross frame elements relative to the first and second size-adjustable frame members.

2. The wheelchair seat of claim **1** further comprising a load supporting panel removably fastened to the first size-adjustable frame member, the second size-adjustable frame member, the first cross frame element and the second cross frame element, said panel being adapted for securing the first and second cross frame elements at selected longitudinal positions along the first and second size-adjustable frame members when said panel is fastened to the first and second size-adjustable frame members and the first and second cross frame elements.

3. The wheelchair seat of claim **2** wherein said panel is removably fastened to the first size-adjustable frame member, the second size-adjustable frame member, the first cross frame element and the second cross frame element with a hook and loop fastener.

4. The wheelchair seat of claim **1** wherein the first cross frame element includes a third penetrating frame element and a third receiving frame element, an end of the third penetrating frame element being telescoped within an end of the third receiving frame element, the second cross frame element including a fourth penetrating frame element and a fourth receiving frame element, an end of the fourth penetrating frame element being telescoped within an end of the fourth receiving frame element.

5. The wheelchair seat of claim **1** wherein the first cross frame element includes a first generally tubular sleeve portion, a second generally tubular sleeve portion and an elongate first body portion extending between the first and second sleeve portions, the second cross frame element including a third generally tubular sleeve portion, a fourth generally tubular sleeve portion and an elongate second body portion extending between the third and fourth sleeve portions, the first sleeve portion being adapted to surround the first size-adjustable frame member, the second sleeve portion being adapted to surround the second size-adjustable frame member, the third sleeve portion being adapted to surround the first size-adjustable frame member, the fourth sleeve portion being adapted to surround the second size-adjustable frame member, the first and third sleeve portions being slidable longitudinally along the first size-adjustable frame member and the second and fourth sleeve portions being slidable longitudinally along the second size-adjustable frame member.

6. The wheelchair seat of claim **5** wherein the first sleeve portion has an interior surface configured to fit around an exterior surface of the first receiving frame element of the first size-adjustable frame member, the second sleeve portion has an interior surface configured to fit around an exterior surface of the second penetrating frame element of the second size-adjustable frame member, the third sleeve portion has an interior surface configured to fit around an exterior surface of the first penetrating frame element of the first size-adjustable frame member, and the fourth sleeve portion has an interior surface configured to fit around an exterior surface of the second receiving frame element of the second size-adjustable frame member.

7. The wheelchair seat of claim **6** wherein the first, second, third and fourth sleeve portions each include at least one set screw adapted for engagement with the exterior surfaces of the first receiving frame element, second penetrating frame element, first penetrating frame element and second receiving frame element, respectively, in a manner for securing the first and second cross frame elements at a selected longitudinal positions.

8. An adjustable wheelchair seat comprising:

a first frame member extending generally in a longitudinal direction, the first frame member including a first penetrating frame element and a first receiving frame element, an end of the first penetrating frame element being telescoped within an end of the first receiving frame element;

a second frame member spaced laterally from and extending generally parallel to the first frame member, the second frame member including a second penetrating frame element and a second receiving frame element, an end of the second penetrating frame element being telescoped within an end of the second receiving frame element; and

first and second cross frame elements extending between and slidably connected to the first and second frame members, each of the first and second cross frame elements comprising a first generally tubular sleeve portion, a second generally tubular sleeve portion and an elongate body extending between the first and second sleeve portions, the first sleeve portion of each cross frame element surrounding a respective portion of the first frame member, the second sleeve portion of each cross frame element surrounding a respective portion of the second frame member, the first and second sleeve portions of each cross frame element being independently slidable longitudinally along the first and second frame members, respectively.

9. The wheelchair seat of claim **8** wherein each first sleeve portion has an interior surface configured to fit around an exterior surface of the first frame member, each second sleeve portion having an interior surface configured to fit around an exterior surface of the second frame member.

10. The wheelchair seat of claim **9** wherein the first and second sleeve portions each include at least one set screw adapted for engagement with the exterior surface of the first and second frame members, respectively, in a manner for securing the cross frame element at a selected longitudinal position along the first and second frame members.

11. The wheelchair seat of claim **9** further comprising a load supporting panel removably fastened to the first frame member, the second frame member and the cross frame element, said panel being fastened to the first frame member the second frame member and at least one of the cross frame elements in a manner to secure said one of the cross frame elements at a selected longitudinal position along the first and second frame members when said panel is fastened to the first frame member, the second frame member and said one of the cross frame elements.

12. The wheelchair seat of claim **11** wherein said panel is removably fastened to the first frame member, the second frame member and said one of the cross frame elements with a hook and loop fastener.

13. The wheelchair seat of claim **9** wherein the first and second frame elements each have a generally square cross-

sectional configuration, the first and second sleeve portions of each cross frame element each having a generally square cross-sectional configuration dimensioned to fit around the exterior surfaces of the first and second frame members, respectively.

14. The wheelchair seat of claim **8** wherein the first frame member, the second frame member, the first cross frame element and the second cross frame element together define a generally square seat frame, the wheelchair seat further comprising a load supporting panel removably fastened to the first cross frame element and the second cross frame element, said panel being fastened to the first and second cross frame elements in a manner to secure the first and second cross frame elements at selected longitudinal positions relative to one another when said panel is fastened to the first and second cross frame members.

15. The wheelchair seat of claim **8** wherein the first cross frame element includes a third penetrating frame element and a third receiving frame element, an end of the third penetrating frame element being telescoped within an end of the third receiving frame element, the second cross frame element including a fourth penetrating frame element and a fourth receiving frame element, an end of the fourth penetrating frame element being telescoped within an end of the fourth receiving frame element.

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